2016

Pumpkin Variety Trial URI 2016

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URI Large Carving Pumpkin Trial 2016

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Introduction

Powdery mildew is a disease of particular concern for pumpkin growers in New England because it occurs every year, and often occurs weeks earlier than other foliar fungal diseases such as downy mildew. Improving powdery mildew resistance in pumpkins has potential to significantly reduce the amount of fungicide applied to pumpkin fields. Seed companies are responding to growers' desire to reduce fungicide use by releasing new carving pumpkin varieties with improved resistance to powdery mildew. The objective of this study was to test the new generation of powdery mildew resistant large carving pumpkins for use in Rhode Island. The variety Gladiator was used as the standard, as it is the best-selling large carving pumpkin variety in New England.

The trial was conducted at the University of Rhode Island's Gardiner Crops Research Center in Kingston RI. The soil is Bridgehampton silt loam with a pH of 6.5 and 4 to 5% organic matter. The summer of 2016 was warm and dry, with average high temperatures of 79°F in June, 85°F in July, 86°F in August, and 78°F in September. Total growing degree days (base 50) was 2,506. Total rainfall was only 8.9 inches, 59% of normal.

Methods

Pumpkins were seeded May 27. Between-row spacing was 10 feet. Within-row spacing was 3 feet for entries with compact vines, and 4 feet for entries with standard vines. Plot size was 50 feet long by 30 feet wide with each plot containing 3 rows. Experimental design was randomized complete block with 4 replications. Nitrogen and potassium were supplied at planting by banding 12-1-12 in the furrow at a rate sufficient to supply 40 lbs N/acre. An additional 40 lbs N/acre was applied by side dressing when vines began to run. Seed treatment varied by supplier, resulting in a mix of varieties treated with Farmore FI400, varieties treated with Thiram, and untreated varieties. Entries that were not treated with Farmore FI400 received a furrow drench of Admire Pro at 0.6 oz/1000 ft prior to planting. Weeds within the pumpkin rows were controlled with Strategy (clomazone +ethafluralin) applied before crop emergence. Between rows the weeds were controlled by seeding a 5 foot wide band of teff (*Eragrostis tef*) on June 15. Teff is a dense grass that acts as a living mulch to suppress weeds, but is easily out-competed by pumpkins. Stand establishment was assessed on June 20, and stands were

Figure 1. Pumpkin field in early July showing teff living mulch between rows and the efficacy of the weed control.

adjusted to either 11 plants per row (4 ft. spacing) or 15 plants per row (3 ft. spacing) using transplants. The entire field was sprayed with Sandea (halosulfuron) to control yellow nutsedge when pumpkins had 5 true leaves. In general the herbicides were effective; occasional weeds that grew through the pumpkin canopy were hand pulled. No fungicides were applied. Overhead irrigation was provided with a Kifco water reel, but was insufficient to prevent drought stress during August. All pumpkins were harvested and graded on September 22.

Table 1. Entries, sources, seed treatments, and plant growth habits for the pumpkin trial. Days to maturity are from suppliers' literature.

Variety	Source	Vine Type	In-row spacing	Seed Treatment	DTM
Aladdin	Harris	Short vine	3 ft	Thiram	115
Apollo	Harris	semi-bush	3 ft	Thiram	105
Ares	Harris	large vine	4 ft	FarMore	115
Bayhorse Gold	Rupp	Short vine	3 ft	FarMore	100
Bellatrix	Siegers	Large vine	4 ft	FarMore	100
Camaro	Seedway	semi-bush	3 ft	Thiram	110
Challenger	Seedway	Large semi-bush	4 ft	FarMore	110
Eagle City Gold	Rupp	Short vine	3 ft	FarMore	100
Early King	Siegers	Large vine	4 ft	Thiram	90
Gladiator	Harris	semi-bush	3 ft	Thiram	115
Hulk	Siegers	Large vine	4 ft	FarMore	100
JPN 61560	Johnny's	Large vine	3 ft	None	?
JPN 62005R	Johnny's	Semi-bush	3 ft	None	?
Kratos	Harris	Short vine	3 ft	FarMore	100
Mustang	Seedway	Semi-bush	3 ft	FarMore	100
Warlock	Harris	Short vine	3 ft	Thiram	115

Results

Disease Resistance

The first signs of disease and plant stress became visible at the beginning of August. Pumpkins were rated for severity of powdery mildew and bacterial wilt symptoms on August 3, August 17, and August 29. Powdery mildew severity was also rated on September 9. Disease severity was recorded using a 0 to 5 scale where 0 indicates no disease, 3 indicates moderate disease, and 5 indicates severe disease. For powdery mildew, severe disease was defined as the oldest living leaves being covered with spores. For bacterial wilt, severe disease was defined as extensive leaf death and stunting. Plant deaths were recorded separately on August 17. Canopy retention was evaluated as percent cover on August 29 and September 9.

Figure 2. Pumpkin field on August 3. Disease symptoms are just beginning. Yellowing in inset picture is chlorosis from Sandea herbicide injury.

Powdery Mildew Resistance: Camaro had the best powdery mildew resistance, never developing more than mild disease. Early King and Bayhorse Gold were the most susceptible, with severe disease in all plots by August 17. Overall Mustang, Gladiator, Kratos, Ares, Challenger, and

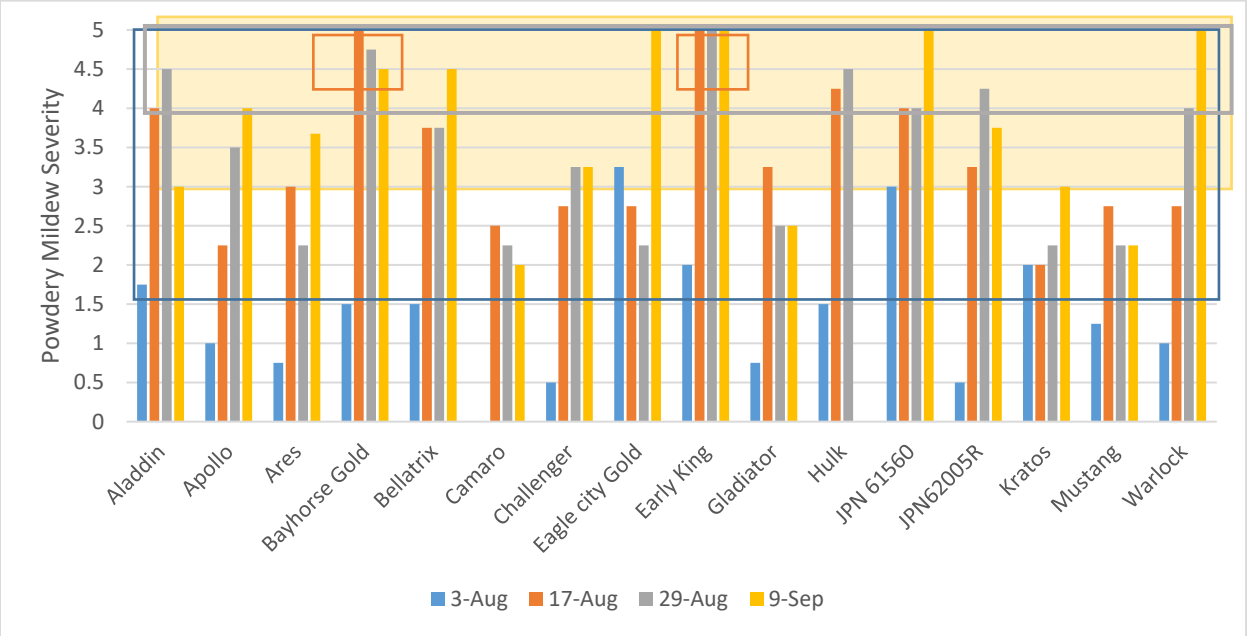

Figure 3. Powdery mildew response of pumpkin entries over time. LSD values are 1.7 for August 3, 1.9 for August 17, 1.7 for August 29, and 1.1 for September 9. Camaro had no disease on August 3. Hulk was completely defoliated on September 9 so could not be rated. Entries where scores decreased over time had powdery mildew primarily on foliage that was injured by Sandea herbicide; as these leaves senesced powdery mildew severity decreased. Colored frames indicate entries that had significantly more disease than Camaro on each date.

Apollo were similar to Camaro. These entries probably would not have developed disease if they had not been intermixed with susceptible entries in the field.

Bacterial Wilt Response: All pumpkins are susceptible to bacterial wilt, but striped cucumber beetles (vectors for the bacteria) have been shown to prefer some varieties over others. In addition, in mild and moderate infections, plants' genetic ability to tolerate stress may limit disease. All of the trial entries were protected with systemic insecticide, either as a seedcoat application of thiamethoxam (Farmore FI 400) or as a furrow drench of imidacloprid (Admire Pro). These insecticide treatments are generally sufficient to prevent extensive defoliation and disease infection on seedling pumpkins, but efficacy decreases over time. Striped cucumber beetle arrived in the pumpkin fields on June 19, three weeks after pumpkins were seeded. Bacterial wilt damage was evaluated on August 3, 17, and 29.

Camaro was least affected by bacterial wilt, with no dead or wilted plants and minimal leaf death. Warlock, Apollo, JPN 61560, and Eagle City Gold were severely affected, with many wilted and dead plants and extensive leaf death. Symptoms were compounded by drought stress on August 17, increasing severity across all entries.

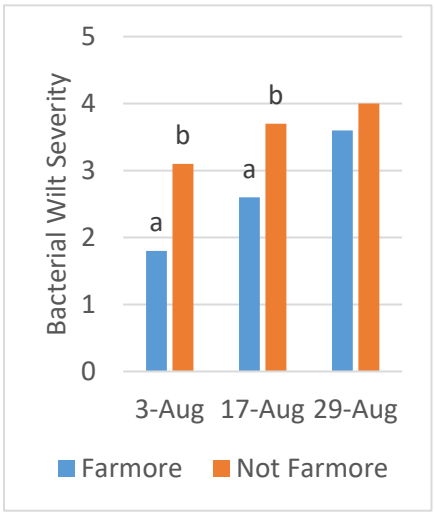

Figure 4. Differences in bacterial wilt severity in entries receiving different seed treatments.

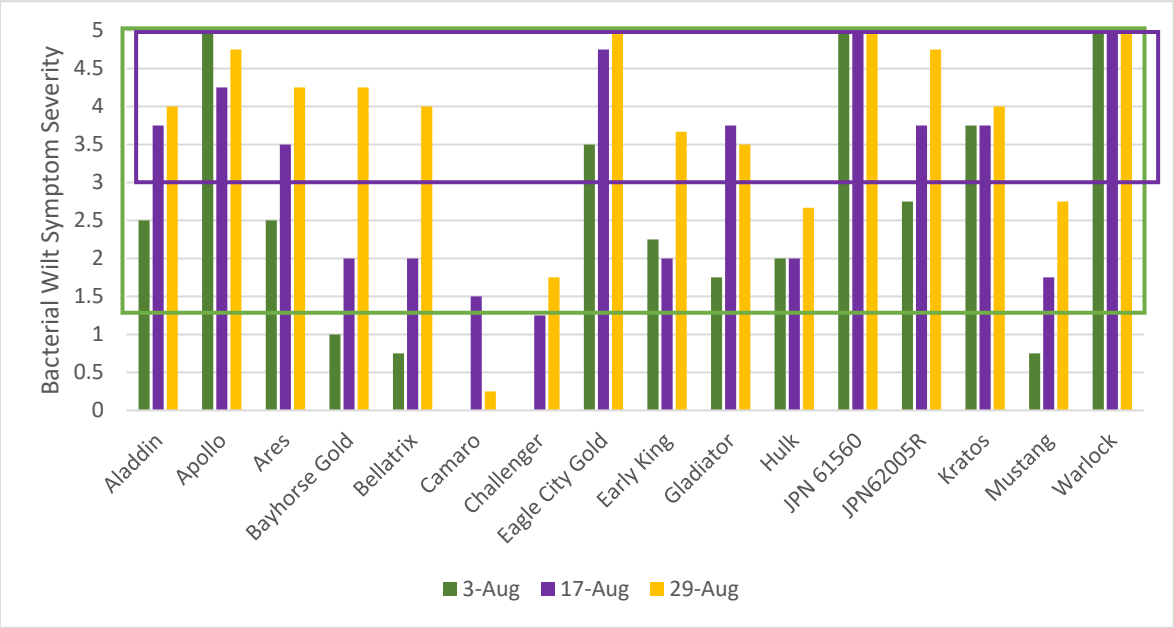

Figure 5. Bacterial wilt damage over time. LSD values are 1.3 for August 3, 1.4 for August 17, and 1.5 for August 29. Camaro and Challenger had no disease on August 3. A score of 5 indicates extensive foliar burn and many stunted or dead plants. A score of 3 indicates foliar burn on crown leaves, but few or no stunted or dead plants. Colored frames indicate significant differences from Camaro on the corresponding dates. All entries had significantly more disease than Camaro on August 29.

Farmore seed treatment was more effective than the Admire Pro furrow drench at preventing plant death prior to fruit maturity and delaying development of bacterial wilt symptoms. The Farmore-treated entries averaged 3% premature plant death, while the entries that received the furrow drench averaged 11% premature plant death. The entries receiving the furrow drench also had significantly more bacterial wilt damage on August 3 and 17, but by August 29 damage levels were similar for both groups. However, it is worth noting that Camaro, which had the least bacterial wilt of any entry, was not Farmore treated, and that Eagle City Gold, which was severely damaged, was Farmore treated.

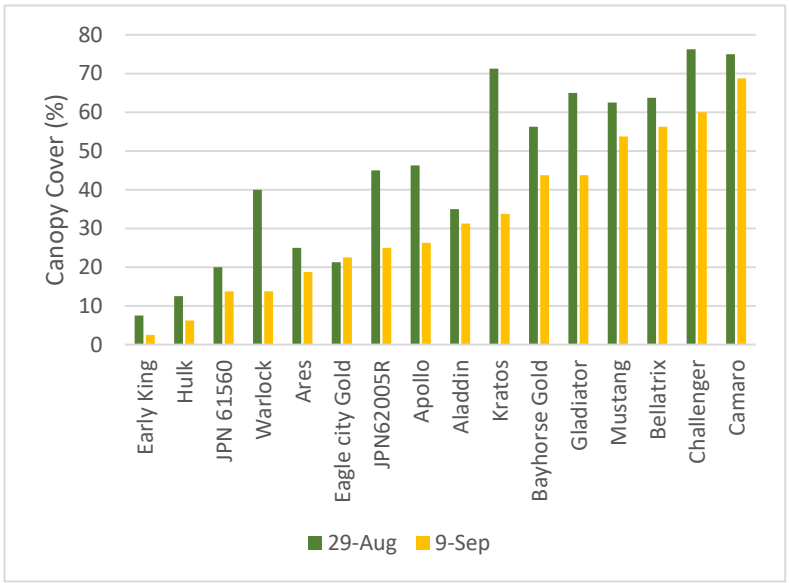

Figure 6. Canopy Retention on August 29 and September 9. Almost 2 inches of rain fell over the intervening 10 days. LSD values are 24% for August 29 and 27% for September 9.

Canopy Retention: Retaining a good leaf canopy until pumpkin harvest decreases sunscald damage on fruit and can increase fruit weight. Fungal disease, water stress, and herbicide injury all cause leaf death, particularly death of crown leaves. Hulk and Early king had lost most of

their crown leaves to powdery mildew and Sandea damage by August 17, and were essentially defoliated by August 29. JPN 61560 and Eagle City Gold lost their leaves to Sandea and bacterial wilt. Mustang, Camaro, and Challenger had dense, semi-bush plants and retained good canopies, while Bellatrix had two plots with excellent canopy and two with extensive defoliation.

Figure 7. Pumpkin fruit ready for harvest in mid-September. Note the wide variation in canopy retention.

Yields

At harvest we collected data on the total number of fruit per plot, and the number of marketable fruit per plot. To be marketable, fruit had to be uniformly orange, undamaged, and have a peduncle that was hard rather than dry or corky. Most fruit were unmarketable due to dead, dry stems. From each plot we selected the largest fruit, the smallest marketable fruit, and 4 typical fruit for weighing and measuring.

Table 2. Fruit yields by plot and by plant. Each plot was 1500 ft ^{2} (1/29 acre) and contained either 33 or 45 plants depending on density.

Variety	Total Fruit	Marketable Fruit	Per Plant
Aladdin	56	43	0.9
Apollo	56	35	0.8
Ares	52	46	1.4
Bayhorse Gold	57	47	1.0
Bellatrix	50	43	1.3
Camaro	73	62	1.4
Challenger	49	44	1.3
Eagle City Gold	59	40	0.9
Early King	58	43	1.3
Gladiator	61	45	1.0
Hulk	43	34	1.0
JPN 61560	51	29	0.6
JPN62005R	49	37	0.8
Kratos	59	44	1.0
Mustang	61	53	1.2
Warlock	56	26	0.6
LSD	*12*	*12*	*0.3*

Fruit Numbers: Camaro produced the most fruit, and the most marketable fruit – significantly more than the other entries. At the spacing used in this trial we would expect Camaro to produce over 1,800 marketable pumpkins per acre. Mustang and Gladiator tied for second for total fruit production but many other entries were similar. Mustang was also second for marketable fruit per plot. Camaro and Ares tied for most marketable fruit per plant at 1.4; the lower yields per acre for Ares reflect the lower plant density required to accommodate the longer vines.

Fruit Size: JPN61560 had the heaviest fruit, up to almost 30 pounds. Hulk, Challenger, Bellatrix, Early King, and Mustang were statistically similar. However, fruit weight was highly variable, with the smallest fruit weighing as little as 5 lbs. Average fruit weight ranged from 12 lbs for Eagle City Gold to 18 lbs for Early King. These averages were noticeably lighter than expected for pumpkins in this size class; fruit were likely due to drought stress. Eagle City Gold,

Ares, and Warlock had the least variation between largest and smallest fruit, while JPN 61560 had the most.

While fruit were lighter than expected, fruit size (height and girth) were typical for the size class. Girth ranged from 89 cm for Early King down to 72 cm for Eagle City Gold, with only Hulk, Bayhorse Gold, Apollo, and Eagle City Gold being significantly thinner than Early King. There was no significant variation in height, which averaged 36 cm.

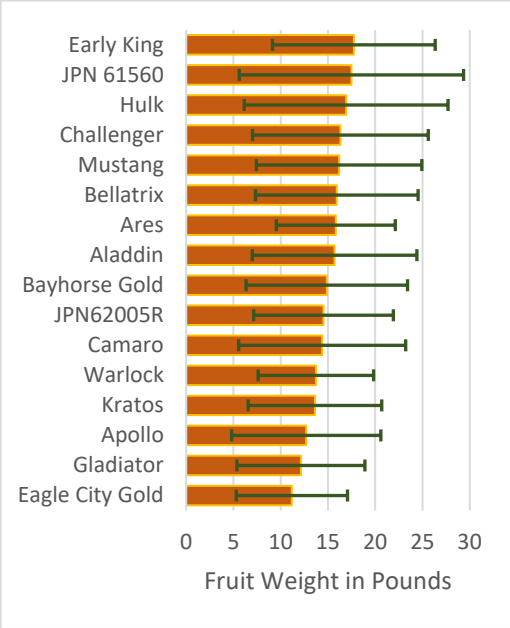

Figure 8. Range in fruit weights. Orange bars indicate the average weight for each entry, while the error bars indicate the range from smallest to largest fruit. LSD values were 1.6 for average weight, 2.9 for weight of the largest fruit, and 1.6 for weight of the smallest fruit.

Conclusions

Camaro was the top performer in the trial with excellent disease resistance and the highest yields. Plants were compact and dense with good canopy cover over fruit. The Camaro plants were less than five feet wide, so could probably be planted with less than 10 feet between rows. Camaro was about average in size, producing 15 lb fruit under our conditions with the potential to produce 20-25 lb fruit.

Other entries worthy of note included Challenger and Mustang. Both had better disease resistance and foliage retention than Gladiator, and larger fruit than Camaro. Mustang produced as many fruit as Gladiator, but slightly fewer marketable fruit due to higher levels of disease. Challenger produced almost as many fruit per plant as Camaro, but was planted at a lower density.

The standard variety, Gladiator, was a very strong performer, and newer varieties offer few improvements in disease resistance and yield. However, Gladiator had relatively small fruit.

Acknowledgements

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